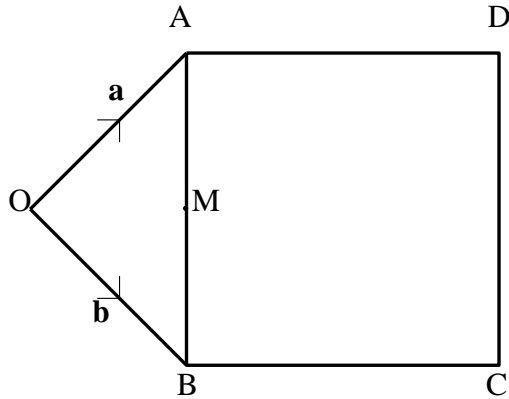


National 5

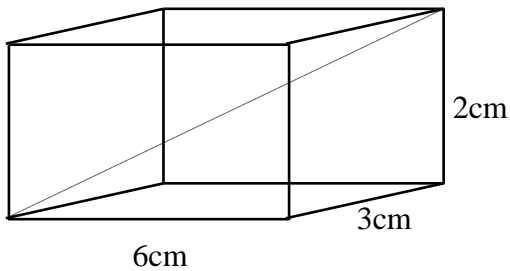
Homework AP19

1. In the diagram below ABCD is a square and triangle OAB is right-angled at O with $OA = OB$. Relative to the origin O, A and B have position vectors **a** and **b** respectively.



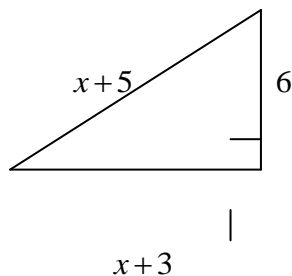
- (a) Express \overrightarrow{AB} in terms of **a** and **b**.
(b) If M is the mid-point of AB, express \overrightarrow{OM} in terms of **a** and **b** and hence or otherwise express \overrightarrow{OD} in terms of **a** and **b**.

2.



The edges of the above cuboid have lengths as shown.

- (a) Calculate the length of the space diagonal shown by the dotted line.
(b) Calculate the size of the angle between the space diagonal and the base.
3. A cube has space diagonals of length 12 cm.
Calculate the length of an edge, giving your answer as a surd in its simplest form.
4. Find algebraically the value of x in the right-angled triangle sketched below.



5. Simplify

(a) $\frac{a^3 \times a^{-1}}{a^{-5}}$

(b) $a^{-3} - 1$

(c) \sqrt{x}^6

6. A doctor's travelling expenses, £C, are worked out as follows:

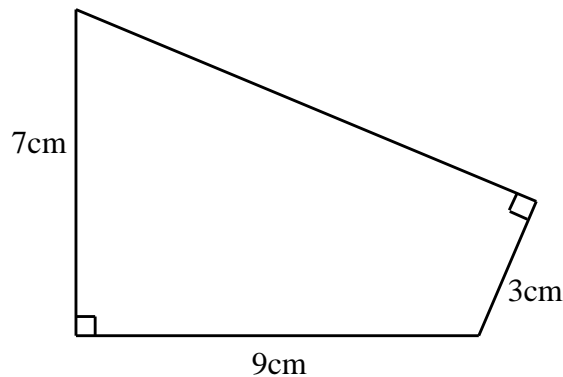
For journeys of 150 miles or less $C = \frac{18N}{100}$

For journeys of more than 150 miles $C = 27 + \frac{12(N-150)}{100}$,

where N is the number of miles travelled.

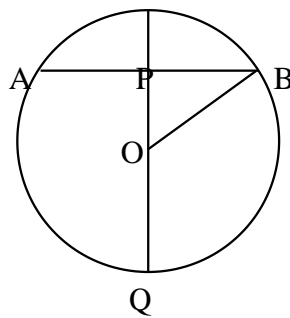
- (a) How much is she paid for a 90 mile journey?
 (b) How much is she paid for a 216 mile journey?

7. What, in square centimetres, is the area of the quadrilateral sketched below?



8. The diagram below shows the circular cross-section of a large sewer with radius $OB = 1.2$ metres. The surface of the effluent, AB , has length 2 metres.

- (a) Calculate the maximum depth of the effluent, PQ .
 (b) What other depth of effluent would give a surface of length 2 metres? Explain your answer.



9. A ship is spotted at position R, which is on a bearing of 315° from a lighthouse L. The distance between R and L is 10 kilometres.
 After the ship has travelled due west to position T, its bearing from the lighthouse is 300° . How far has the ship travelled from R to T?

10. Simplify

(a) $\frac{1}{a-1} - \frac{2}{a+1}, \quad a \neq \pm 1$

(b) $\frac{3}{x^2} + \frac{2}{x^3}, \quad x \neq 0.$